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Spin polarization of non-equilibrium Bose-Einstein condensates of semimagnetic exciton-polaritons

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Exciton-polaritons attracted a significant attention over the last years, leading to the observation of such phenomena like non-equilibrium Bose-Einstein condensation [1] or polariton lasing [2]. However, the investigation on the effect of magnetic field on exciton-polariton coherent phenomena is still at an early stage, even though many interesting phenomena such as the Meissner [3] or magnetopolaron [4] effects have been predicted.

The influence of magnetic field on excitonic properties can be increased by doping the quantum wells (QWs) with magnetic ions. We investigate microcavity based on (Cd,Zn,Mg)Te non-magnetic distributed Bragg reflectors with four semimagnetic CdZnMnTe QWs with 0.5% of manganese, grown at Faculty of Physics at the University of Warsaw [5, 6]. The *s*,*p*-*d* exchange interaction between localized electrons with charge carriers results in the amplification of magnetic phenomena in our sample [7]. The observation of the giant Zeeman splitting of bare exciton energy levels with opposite angular momentum projections raises a number of questions about the polarization of non-equilibrium Bose-Einstein condensates of semimagnetic exciton-polaritons, resulting from strong coupling between such excitons and cavity photons.

With increasing excitation power of a non-resonant pulsed laser we exceed the linear regime of polariton-polariton interactions and observe the manifestation of polariton condensation as nonlinear increase of the emission intensity, energy blue-shift, line narrowing and buildup of linear polarization, in agreement with previous works performed on non-magnetic structures [1]. The degree of the linear polarization (DOLP) is observed to decrease with magnetic field, although even up to 9 T it has a significant, non-vanishing value. Simultaneously, a rotation of polarization angle of about 30° from the orientation at zero external magnetic field, is observed.

With decreasing DOLP, the degree of circular polarization (DOCP) increases with the dominant σ^+ polarization of the emitted light in high magnetic fields. This effect is however very weak as expected from the semi-magnetic exciton-polaritons, where the giant Zeeman splitting leads to the separation of the two spin-component of lower polariton branch already at the magnetic field as low as 1 T. The fastest increase of the DOCP up to about 70% at 7 T is observed for the highest investigated excitation power. Our experimental observations suggest the existence of single-frequency elliptically polarized non-equilibrium polariton condensate in magnetic field.

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